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Centro Nacional de Supercomputación

EXCELENCIA SEVERO OCHOA

MEDSCOPE
MEDiterranean Services Chain based On climate PrEdictions

ENSO teleconnection vs. NAO dynamics in late winter (+ extras)

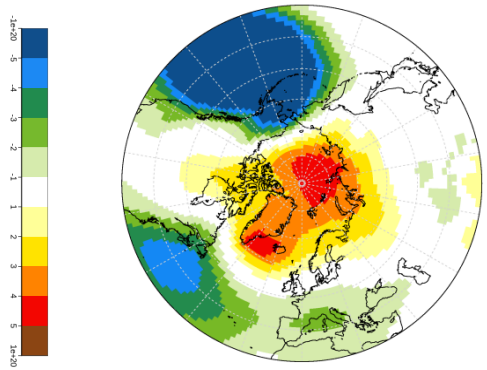
22/01/19

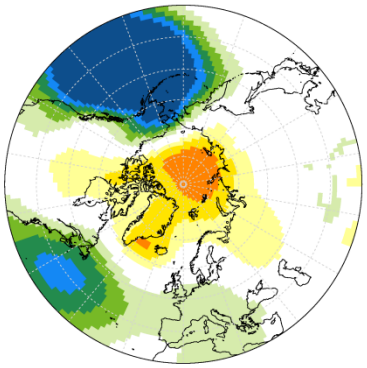
MEDSCOPE WP2 sensitivity experiments workshop

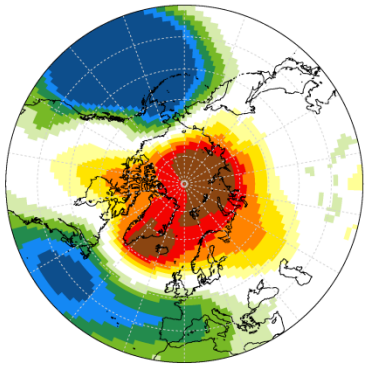
El Niño

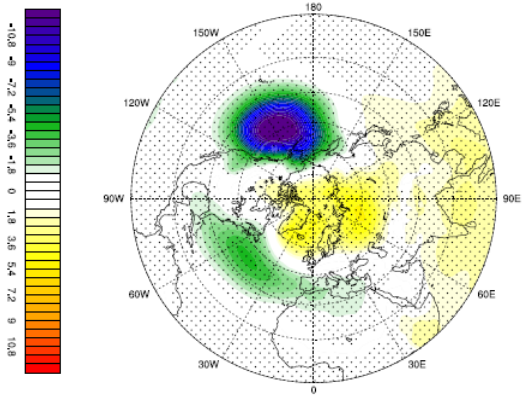
El Niño/PDO+

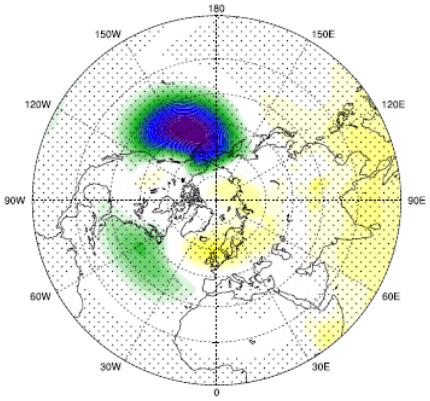
El Niño/PDO-

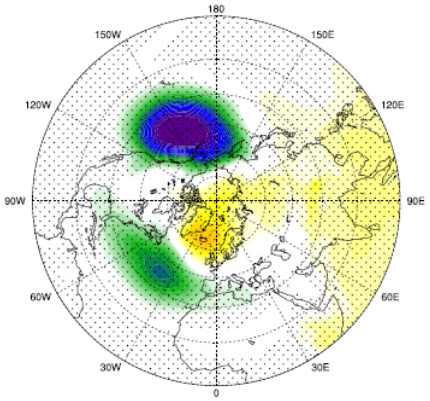












CNRM ARPEGE
(L91 – top 0.01 hPa)

CMCC CAM5.2
(L46 – top 0.3 hPa)

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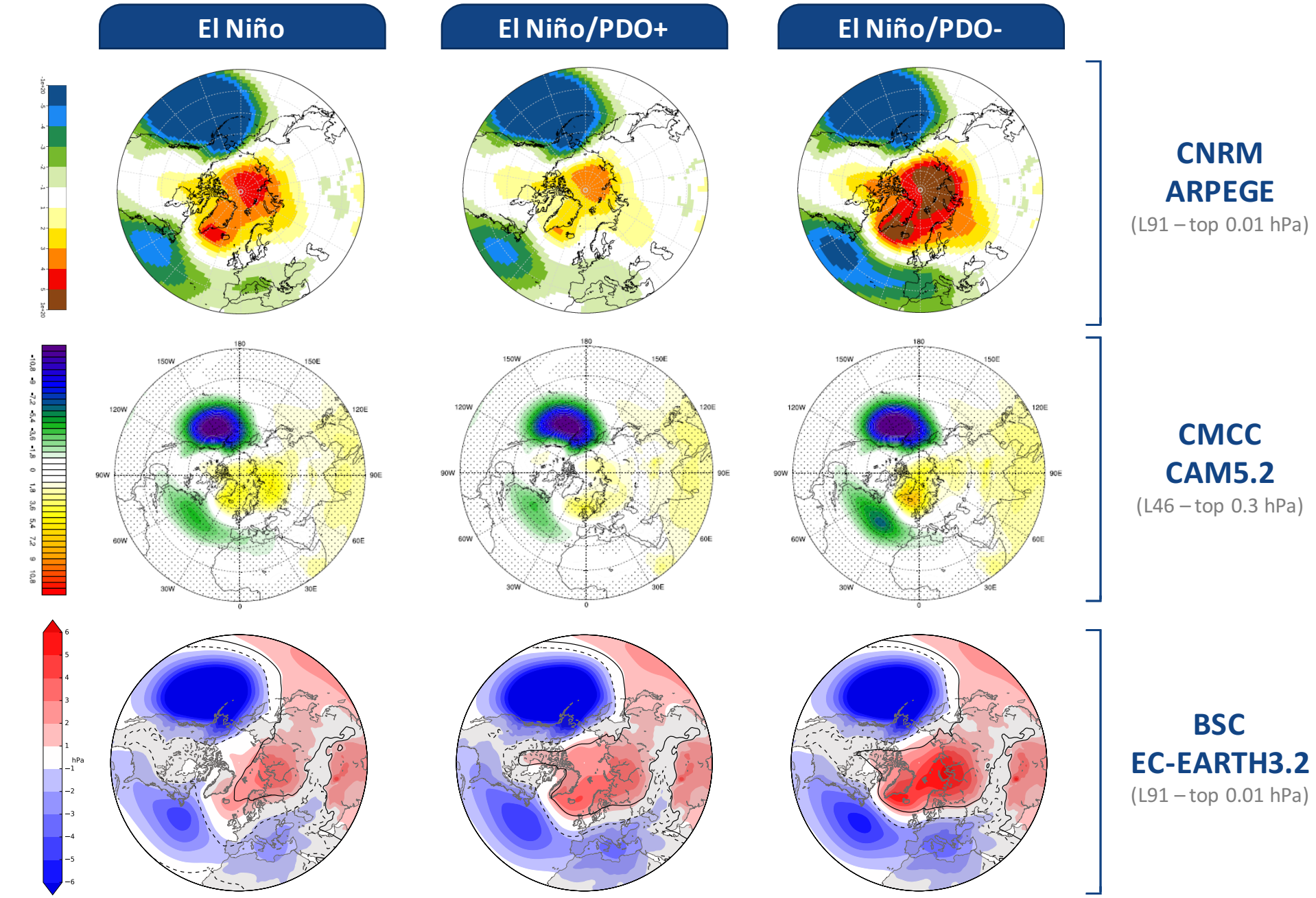
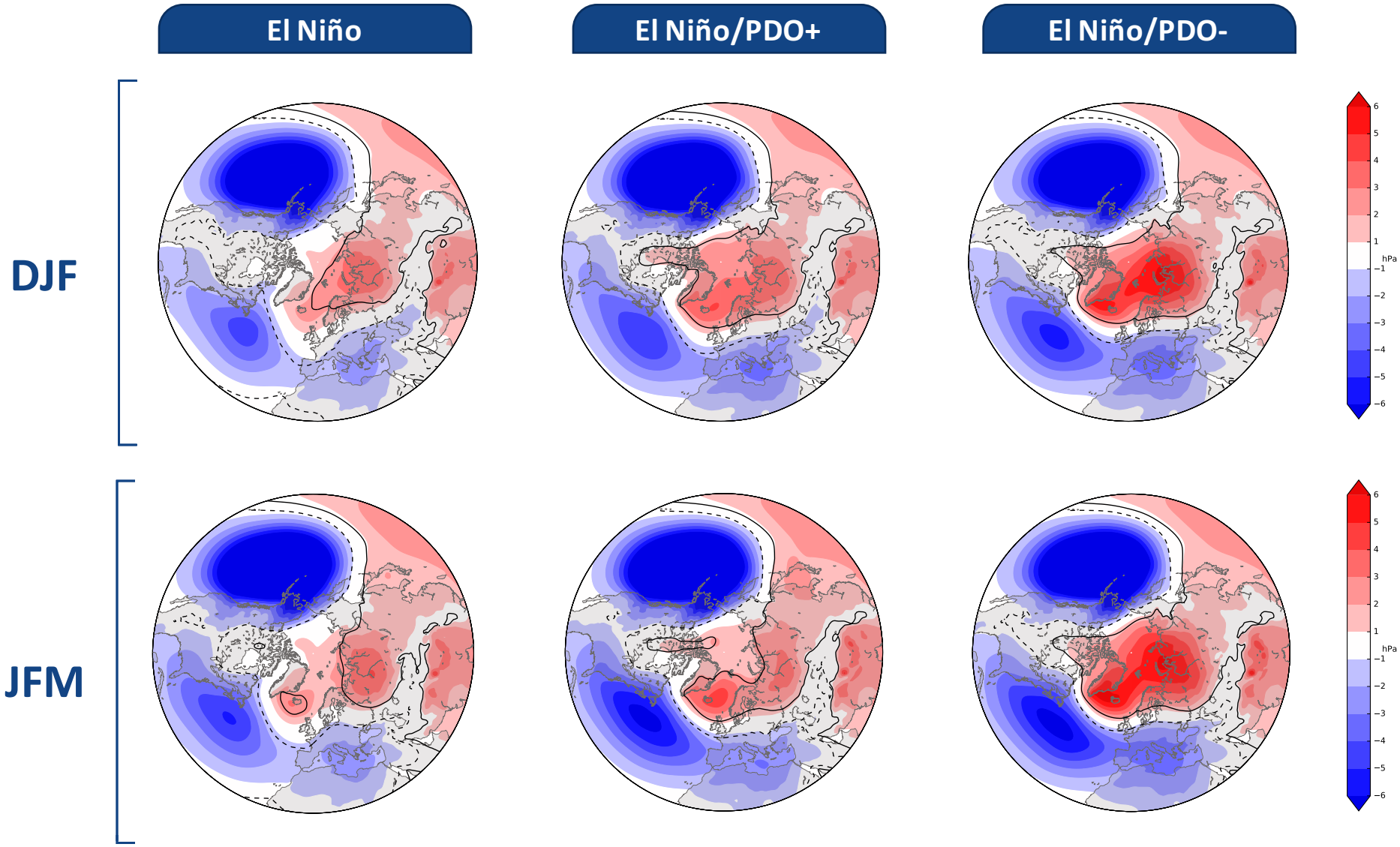

El Niño
El Niño/PDO+
El Niño/PDO-
CNRM
ARPEGE
(L91 – top 0.01 hPa)
CMCC
CAM5.2
(L46 – top 0.3 hPa)
BSC
EC-EARTH3.2
(L91 – top 0.01 hPa)
hPa

About early winter and late winter…



ENSO teleconnection vs. NAO dynamics in late winter

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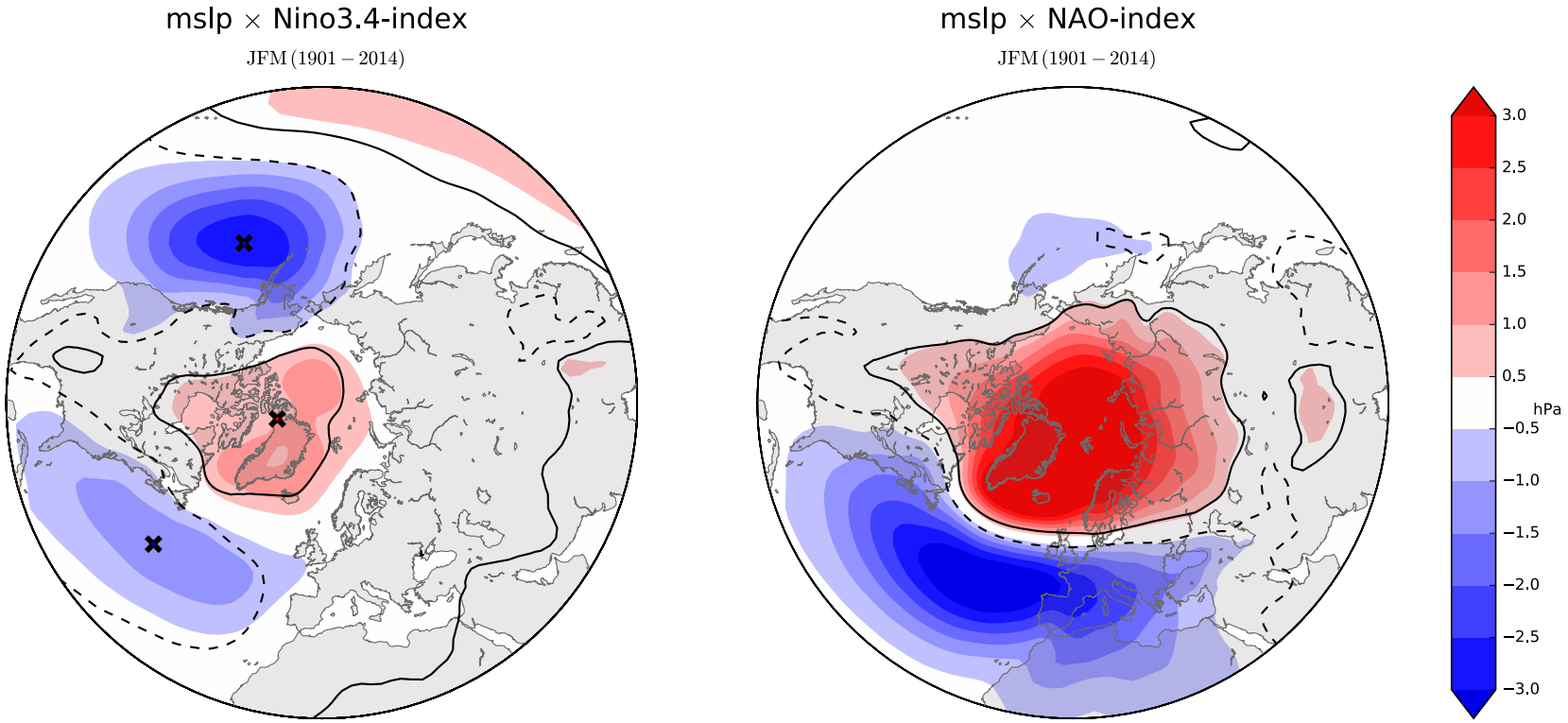
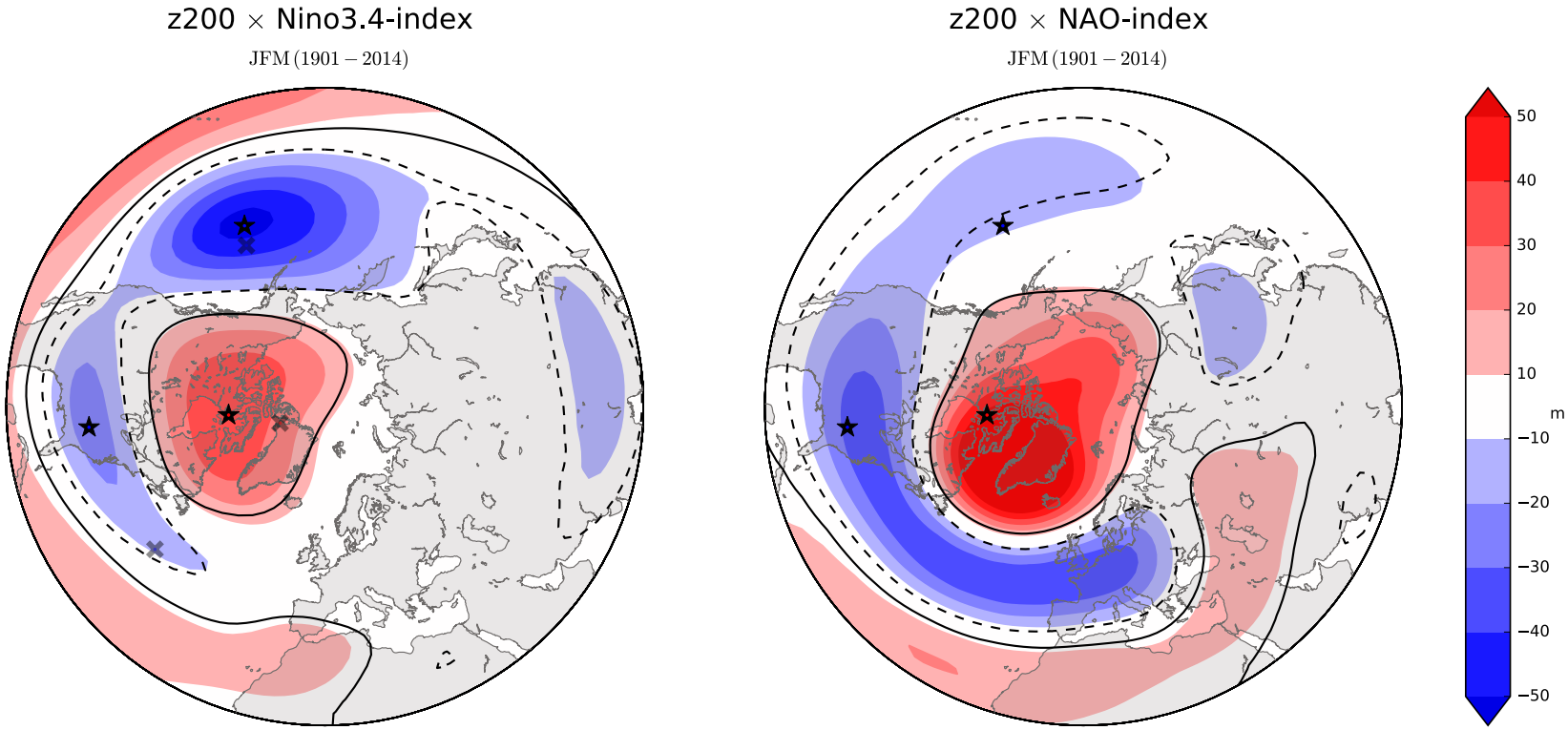
“NAO-like” (?) pattern



NOAA 20th Century Reanalysis

Geopotential Height (200 hPa)



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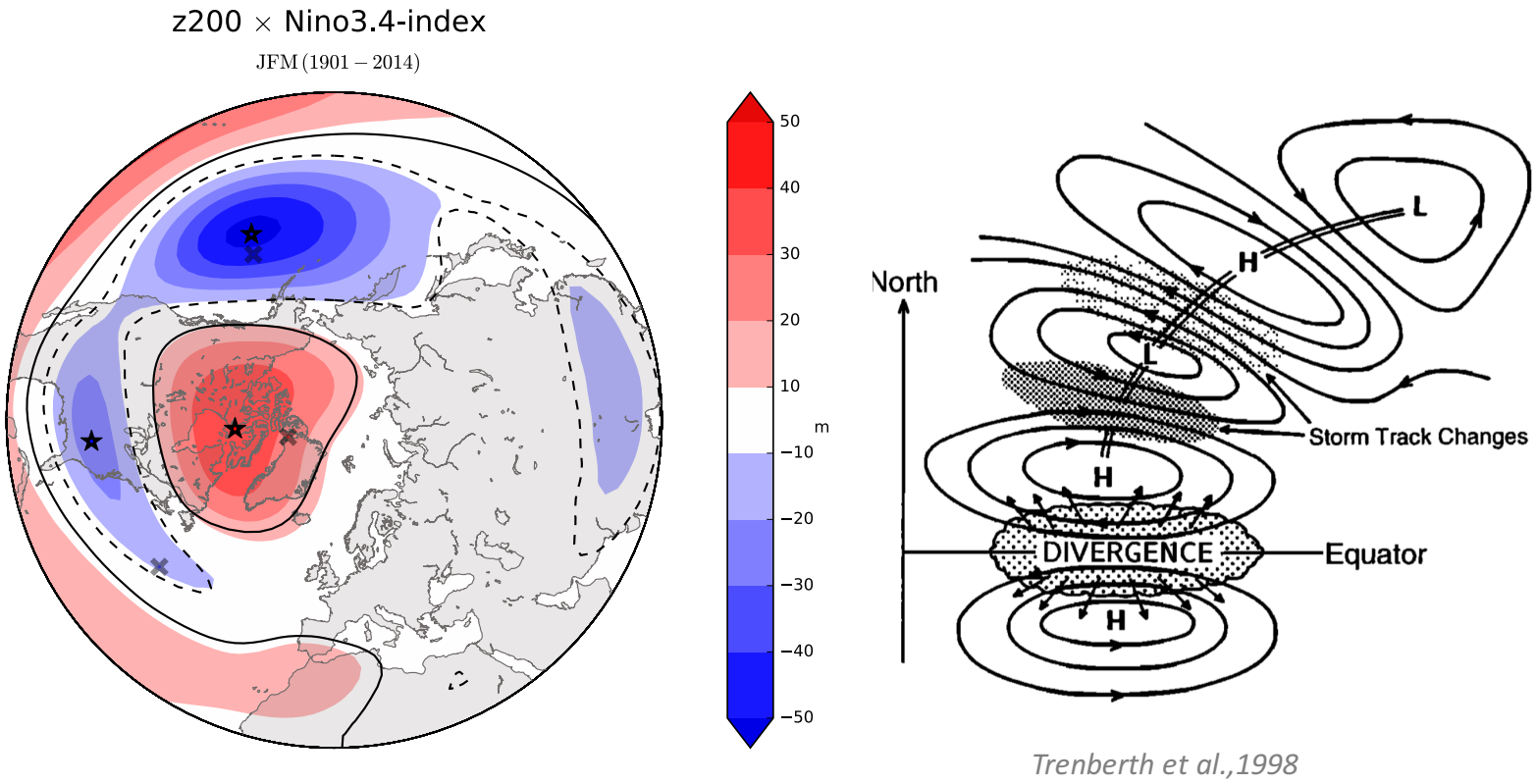
NOAA 20th Century Reanalysis

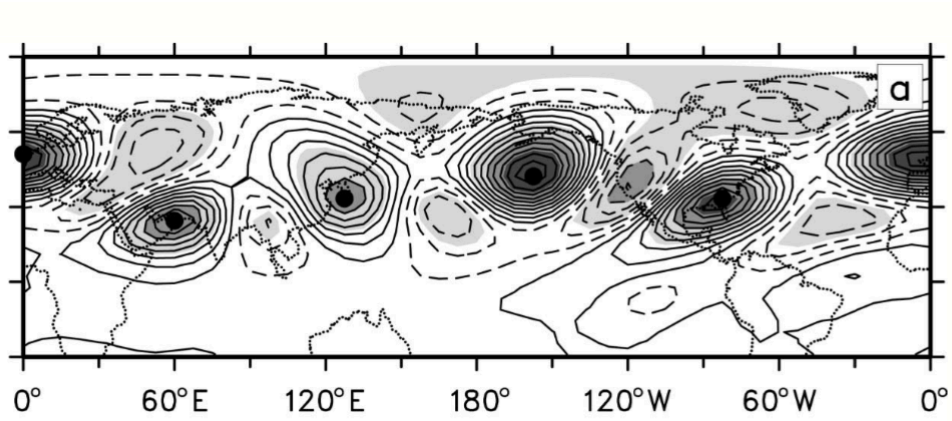
Geopotential Height (200 hPa): ENSO



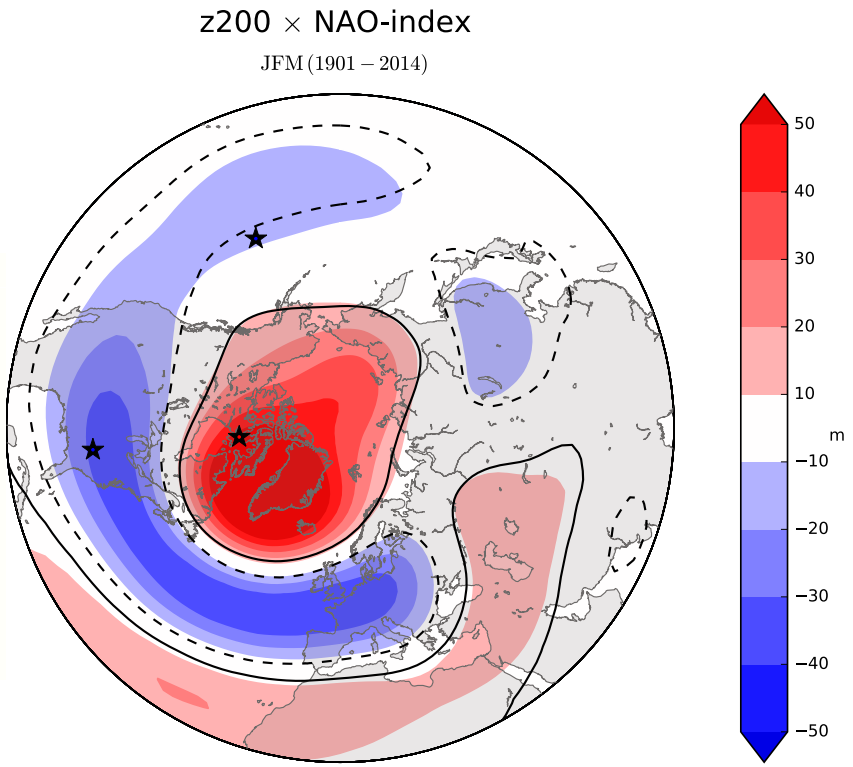
Trenberth et al.,1998

- Tropospheric Rossby wave-train emanating from the Equator and arching north-eastward

Geopotential Height (200 hPa): NAO



Branstator, 2002



- Circumglobal waveguide pattern

Forced and internal variability in AGCMs

Model	*Resolution*	*Period*	*Members*	*Forcing*
SPEEDY (ICTP AGCM)	T30L8	1901-2014	10	Observed SSTs (HadISST)
IFS (ECMWF ERA-20CM)	T159L91	1901-2010	10	Observed SSTs and sea ice cover (HadISST)

SST-forced and internal variability estimated as:

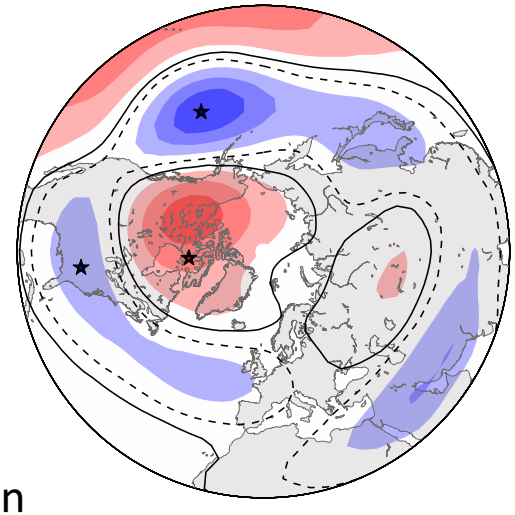
- **Forced:** 1st EOF of the ensemble-mean SLP in the Northern Hemisphere
- **Internal:** 1st EOF of SLP residuals around the ensemble mean, in the NAE

SPEEDY

Forced

z200 × PC1_mslp (ens.mean)

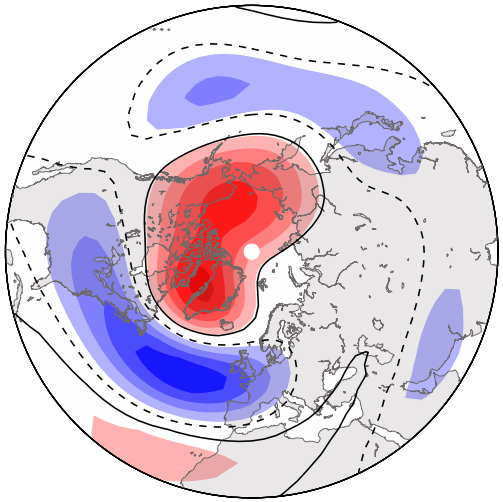
JFM (1901 – 2014)

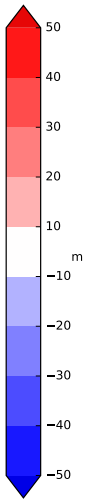


Internal

z200 × PC1_mslp (resid.)

JFM (1901 – 2014)

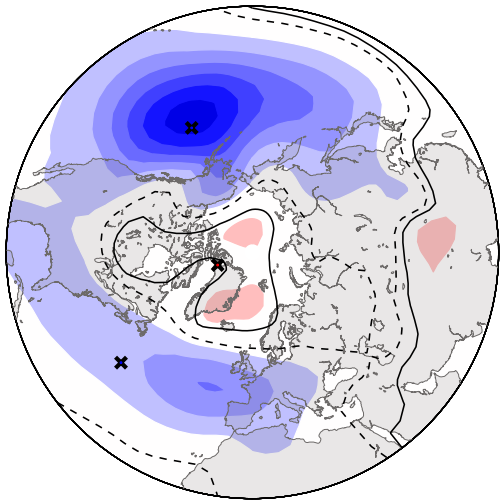




★, ×: comparison with obs

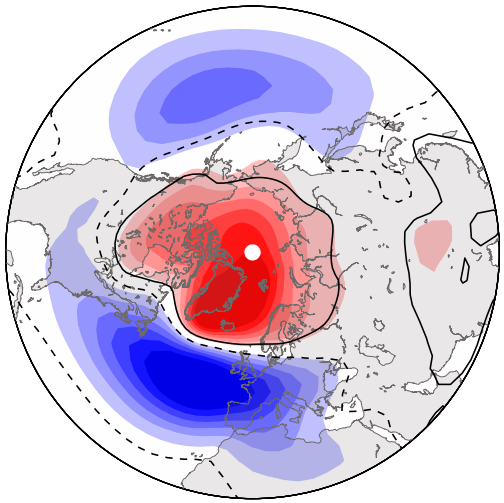
EOF1 mslp NH (ens.mean)

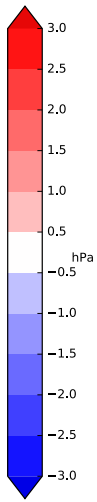
JFM (1901 – 2014)



EOF1 mslp NAE (resid.)

JFM (1901 – 2014)

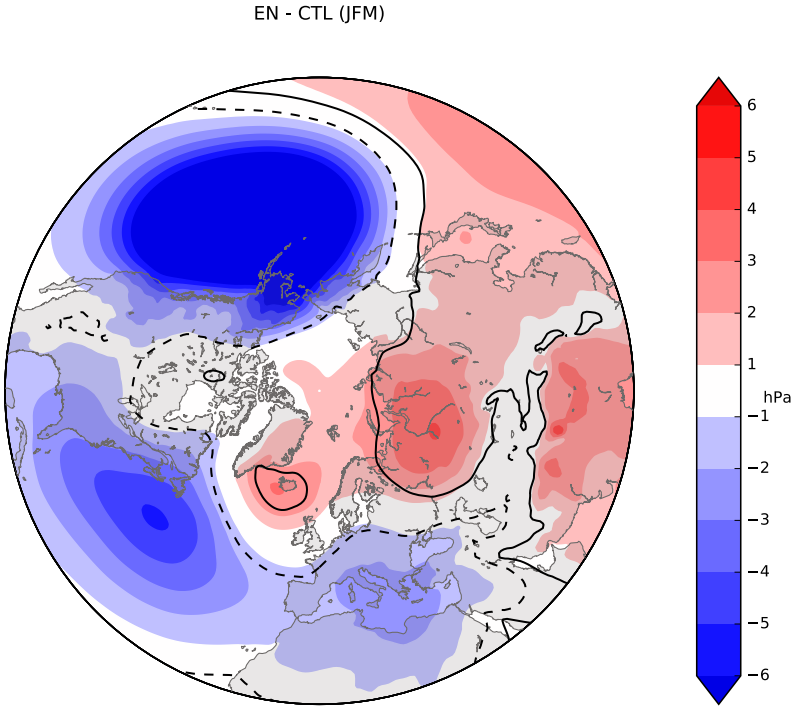


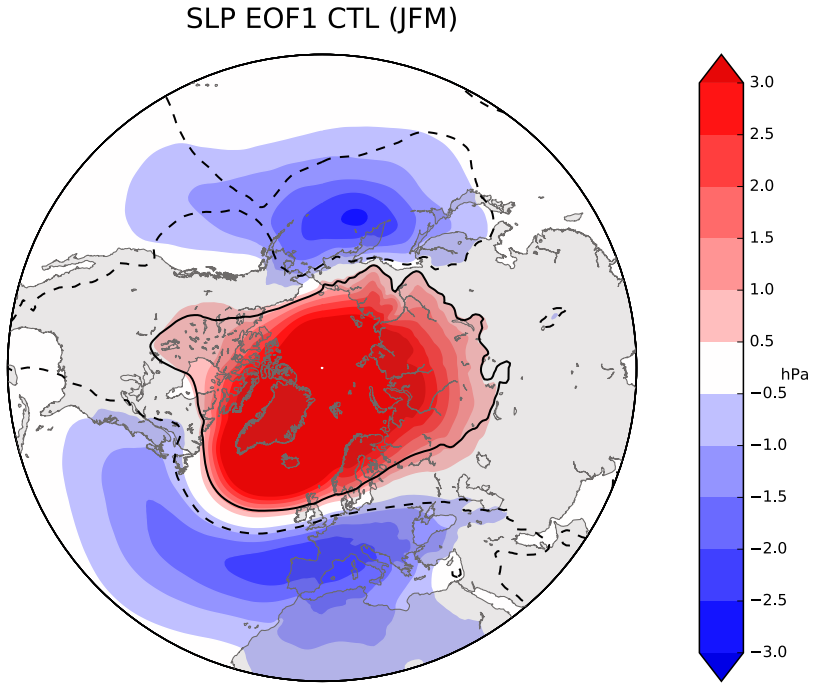


MEDSCOPE sensitivity experiments…

- El Niño
- PDO+
- PDO-
- El Niño /PDO+
- El Niño /PDO-
- Control

Variability in EN vs. CTL





ENSO-NAE teleconnection in late winter

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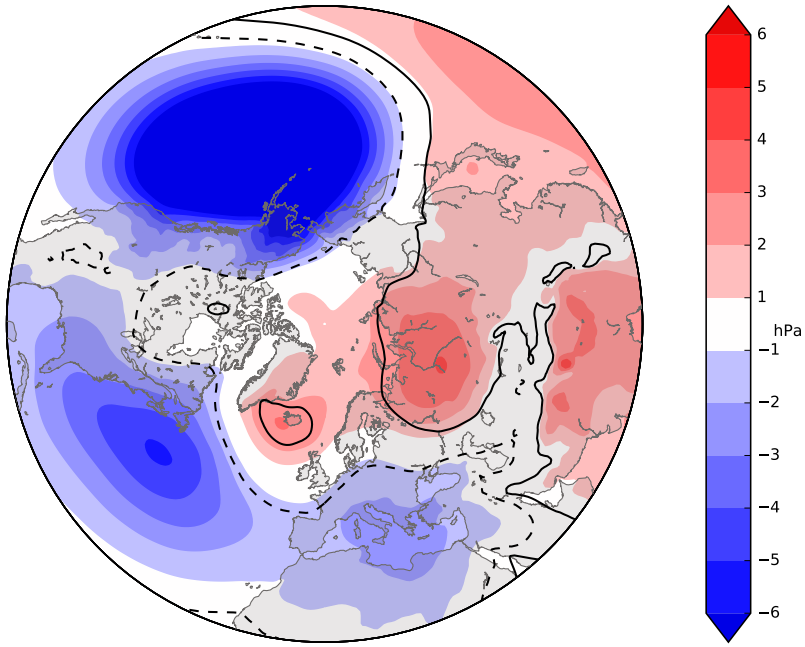
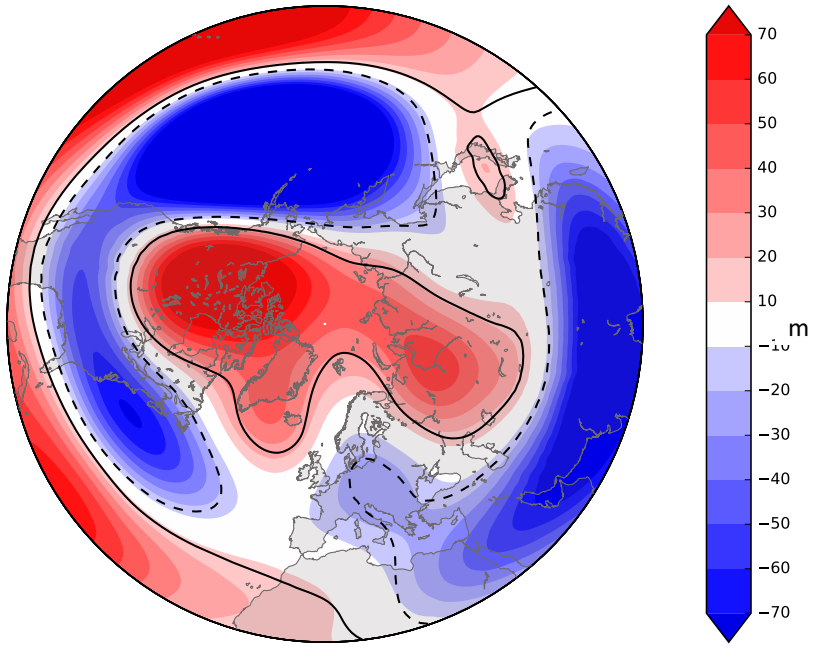
ENSO-NAE teleconnection (in JFM)

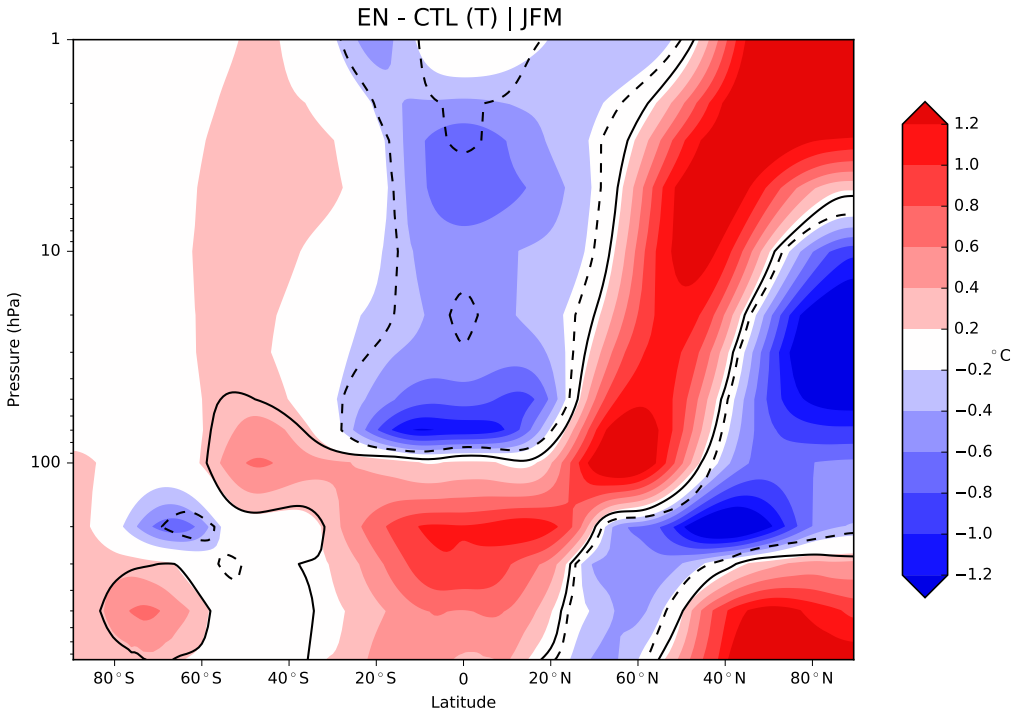
SLP

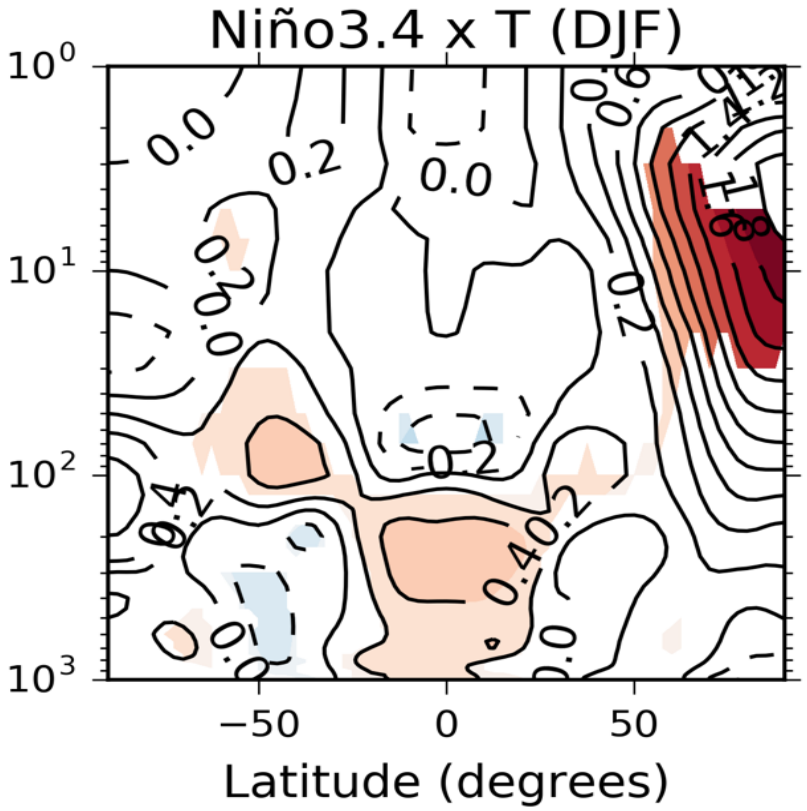


Z200



ENSO-NAE teleconnection (in JFM)





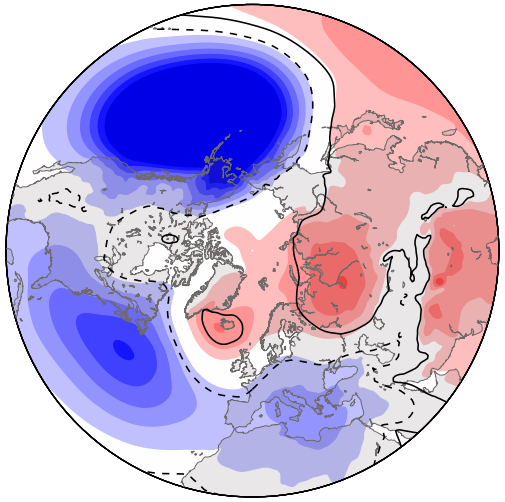
Reanalysis (JRA-55)

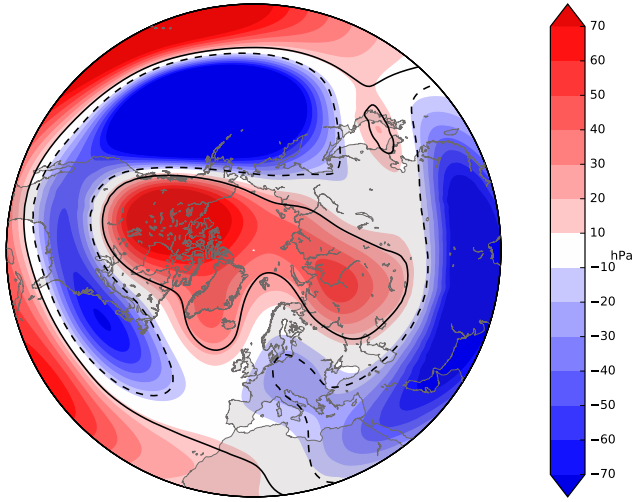
ENSO-NAE teleconnection (in JFM)

SLP

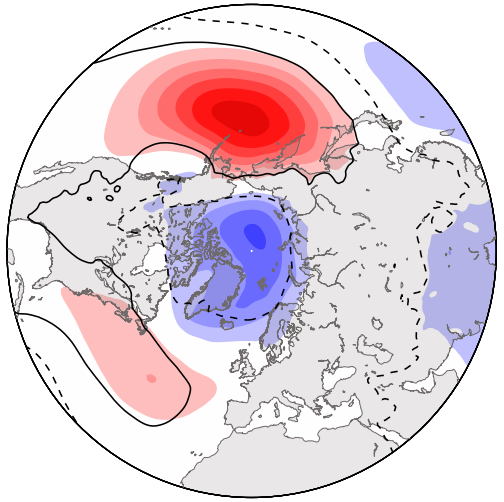
Z200

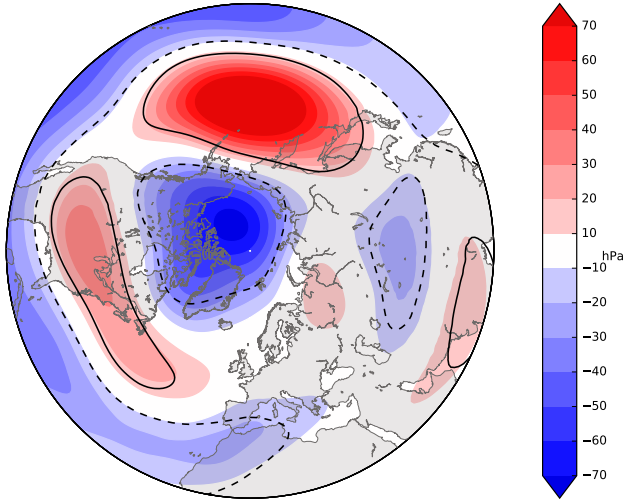
El Niño





La Niña





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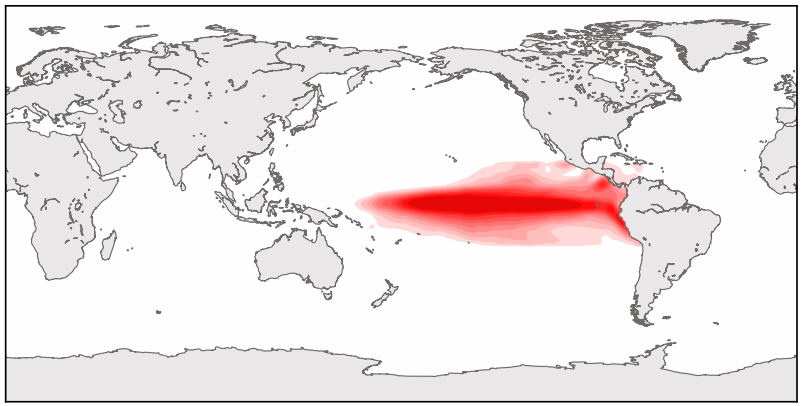
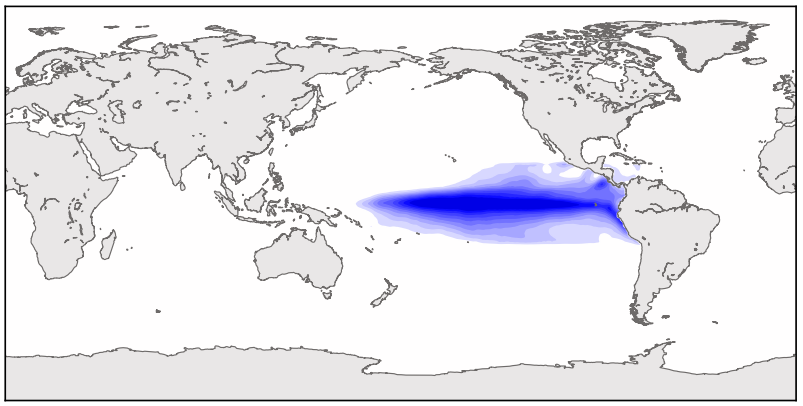
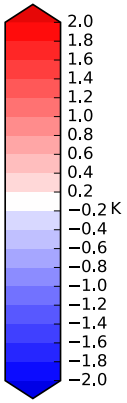
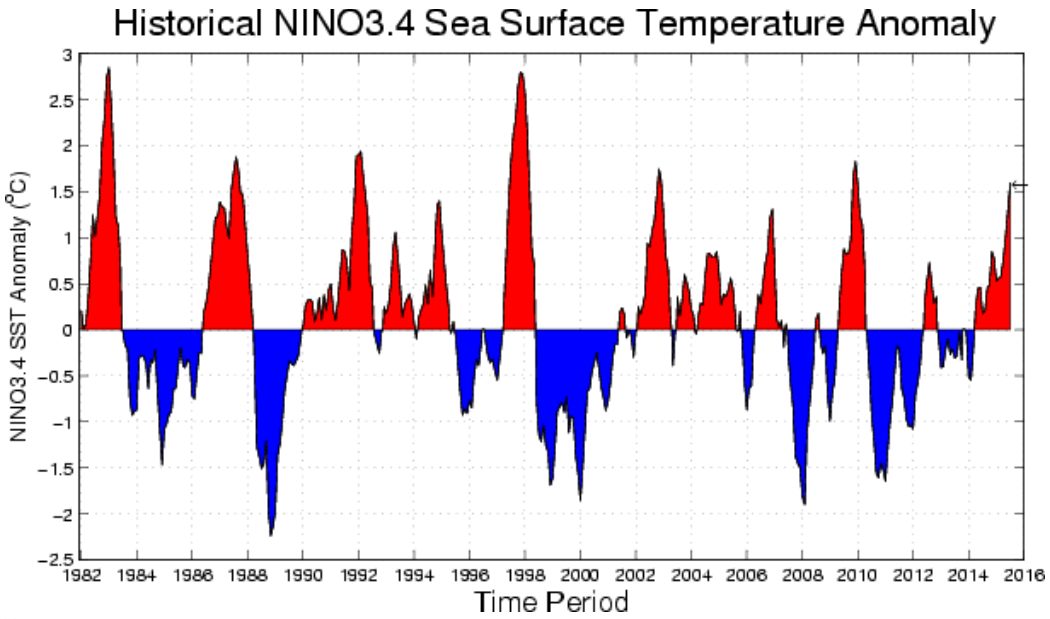
ENSO-NAE teleconnection (in JFM)









Future work/ideas

- Further diagnose regional dynamics: eddy-mean flow interaction ⟶ daily u, v, outputs at 200hPa?; T?
- Further diagnose large-scale dynamics: Rossby wave propagation, arching vs. circumglobal ⟶ U (ray tracing); daily Z at 200hPa ?; u,v for streamfunction; monthly Z in stratosphere (stratospheric variability – Polar Vortex)
- Timing of the ENSO-NAE teleconnection: tropospheric vs. stratospheric pathway
- Multi-model approach!

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EXCELENCIA SEVERO OCHOA

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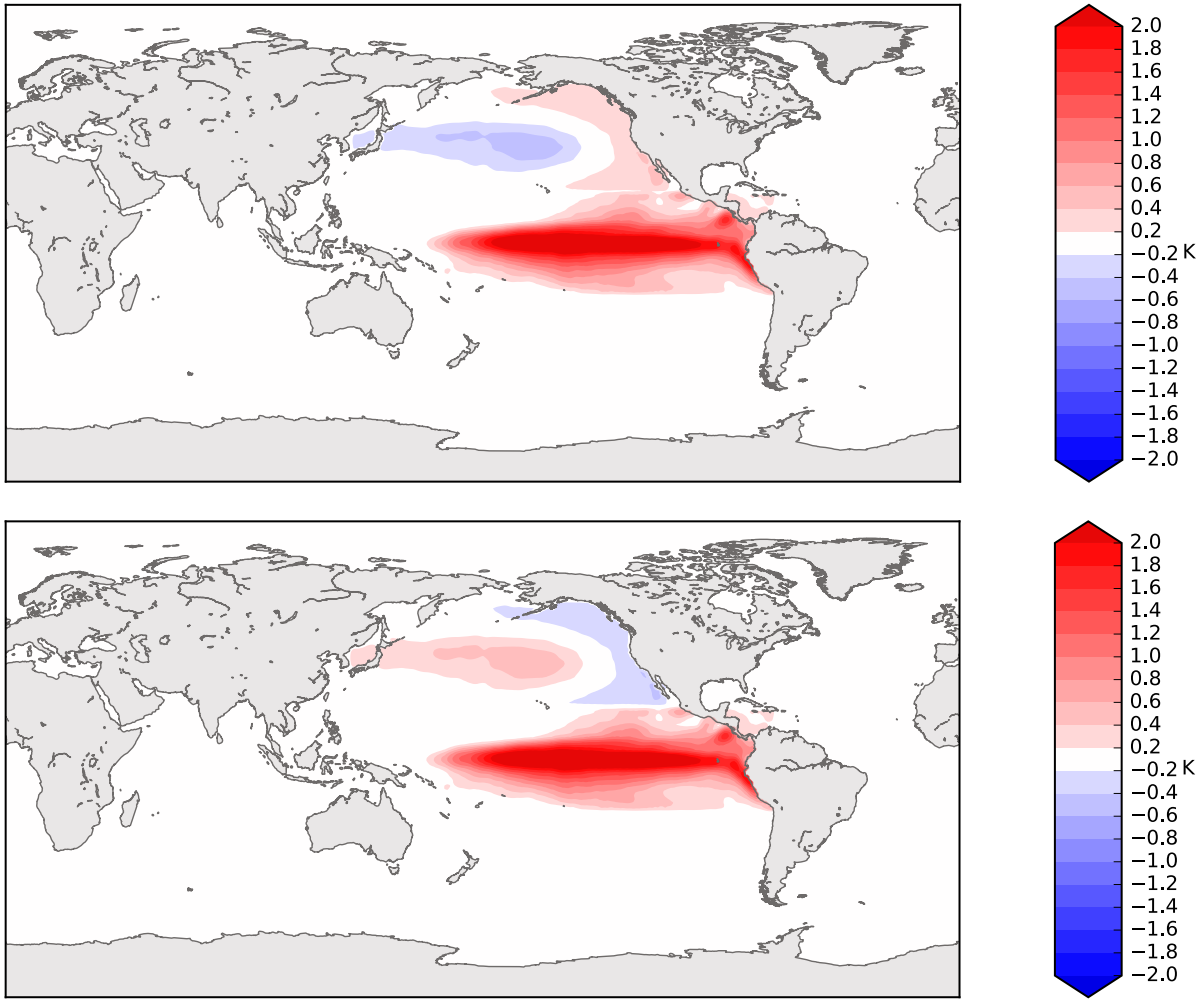
Sensitivity experiments EN/PDO

EN/PDO+

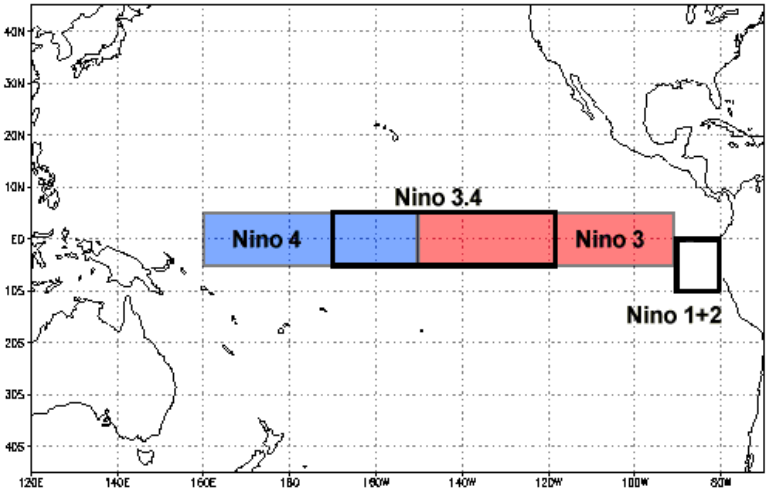


EN/PDO-

Methodology

Linear regression:

- **Nino3.4 Index** = area-averaged SST anomalies over the Niño3.4 region (5°N-5°S; 170°W-120°W).



- **NAO-index** = 1st Principal Component (EOF) of SLP over the NAE domain (20°N-90°N; 90°W-40°E).

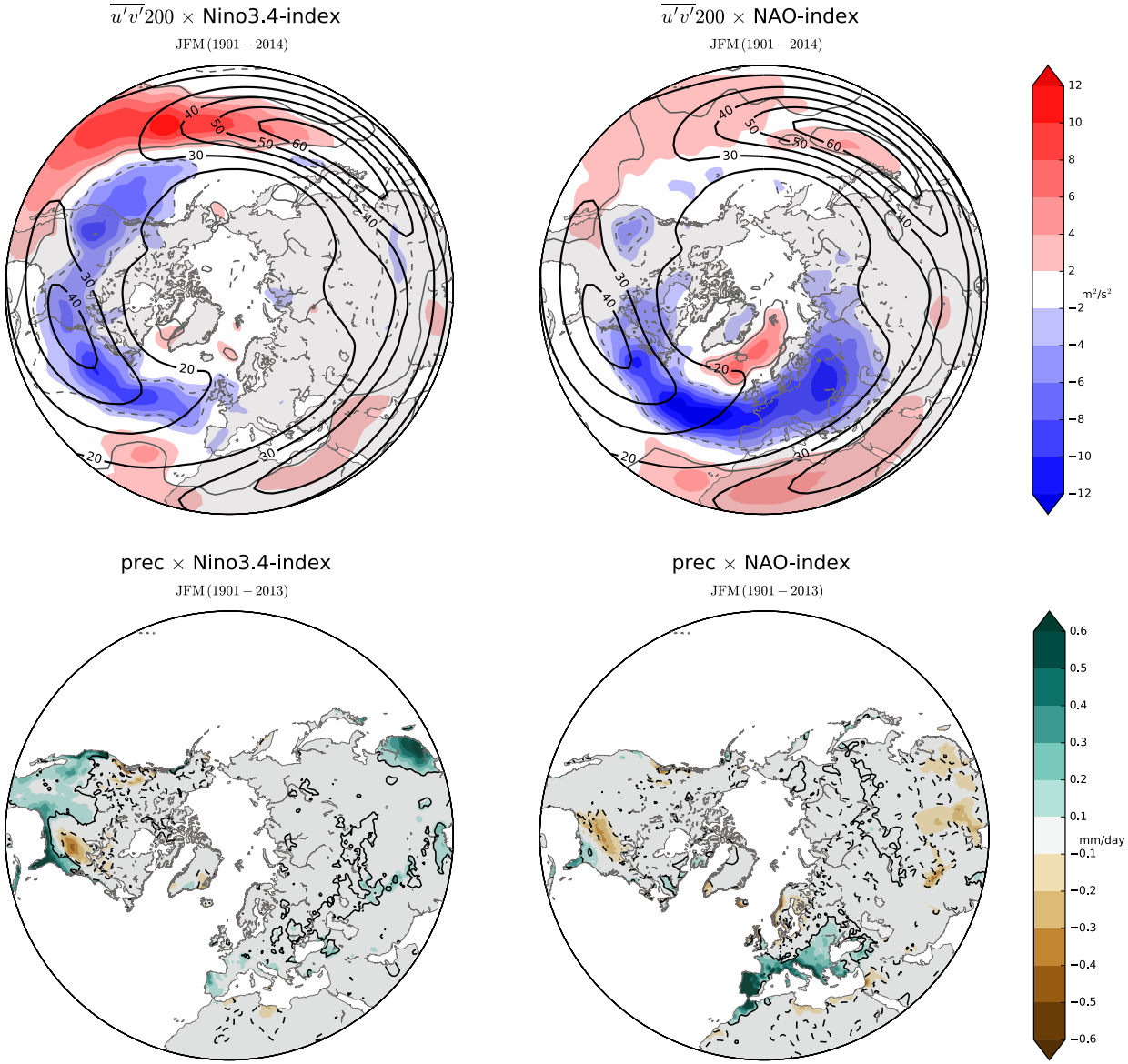
Data:

- HadISST
- NOAA 20th Century Reanalysis (GPCC for precipitation)

1901-2014

Transient-eddy momentum flux (200hPa) and precipitation

24-h filter on daily data



contours = climatological zonal wind